

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2007

## BUDGET ACTIVITY

### 7 - Operational system development

## PE NUMBER AND TITLE

### 0708045A - End Item Industrial Preparedness Activities

COST (In Thousands)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	101170	112223	66869	69495	70081	70635	72189	73777		660059
E25 MFG SCIENCE & TECH	59094	67324	66869	69495	70081	70635	72189	73777		549464
EA2 MANTECH INITIATIVES (CA)	42076	44899								110595

**A. Mission Description and Budget Item Justification:** This program element (PE) funds the Army Manufacturing Technology (ManTech) program. The goal of the ManTech program is to enable producibility and affordability of advanced and enabling technologies by developing reliable manufacturing processes and increasing production yields, which will result in cost savings and reduced risk of transitioning military-unique manufacturing processes to production. The ManTech program assists the Army in meeting the goals and timelines of Future Combat Systems (FCS), the Future Force and, where feasible, the Current Force. The program also fosters the transfer of new/improved manufacturing technologies to the industrial base. This program element comprises two projects. The Manufacturing Science and Technology (E25) project includes manufacturing efforts select that have potential for high payoff across the spectrum of Army systems and/or significant impact on national manufacturing issues. Major investment areas include Aviation, Armor/Survivability, Sensors, Electronics/Power Systems, Precision Munitions/Armaments, and Flexible Displays. Work in this program is related to and fully coordinated with on-going Army Science and Technology efforts such as the third Generation Infrared Technology effort in PE/projects 0603710A/K70/K86, Low Cost High G Mechanical Systems (MEMS) Inertial Measurement Units (IMU) in PE/project 0602303A/214 and the Flexible Display Initiative in PE/project 0602705A/H94. Project EA2 funds congressional special interest items. This PE contains no duplication of effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, and the Army Science and Technology Master Plan (ASTMP), and the Army Modernization Plan. The US Army Research, Development, and Engineering Command manages this PE and efforts are executed by the appropriate Army Research Laboratory and Research, Development, and Engineering Centers.

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<u>B. Program Change Summary</u>	FY 2006	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2007)	111788	68075	68639	69603
Current BES/President's Budget (FY 2008/2009)	101170	112223	66869	69495
Total Adjustments	-10618	44148	-1770	-108
Congressional Program Reductions		-429		
Congressional Rescissions				
Congressional Increases		45400		
Reprogrammings	-10618	-823		
SBIR/STTR Transfer				
Adjustments to Budget Years			-1770	-108

Twenty-three FY07 congressional adds totaling \$43515 were added to this PE.

(\$2780) National Center for Def Mfg & Machining  
 (\$2061) Reactive Atom Plasma (RAP) Processing  
 (\$958) Virtual Parts Program  
 (\$1534) Free Form Low Cost Fabrication Using Titanium  
 (\$2109) Laser Peening for Army Helicopters  
 (\$2875) Manufacturing Systems Demonstration  
 (\$1294) Packaging & Interconnection Technology  
 (\$2780) Adv Modeling-Large Struct Titanium Machining Init  
 (\$1917) Vehicle Common Armor-Affordable Mod MFG Process  
 (\$958) Durable Gun Barrel Steel  
 (\$1054) Electrodeposited Coatings Systems for Munitions  
 (\$958) Legacy Aerospace Gear Drive Re-eng Initiative  
 (\$4265) Low Cost Domestic Titanium Reduction to Powder  
 (\$1294) Smart Machine Platform  
 (\$4601) Spring Suspended Airless Tires for Convoy Protect  
 (\$1917) Super-Pulse Laser Processing Technology  
 (\$1390) Adv Ceramic Mfg & Machining Process Dev  
 (\$1246) High Perf Alloy Materials/Adv Mfg of Steel Casting  
 (\$958) Industrial Preparedness  
 (\$1246) Next Generation Combat Helmet  
 (\$1390) Replicable Def Mfg Management and Solutions System

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(\$2396) Rigid Rod Polyphenylene Com-Lgtwt Cartridge Cases		
(\$1534) Small Heavy Fuel Engines for Tactical UAVs		

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2007

## BUDGET ACTIVITY

### 7 - Operational system development

## PE NUMBER AND TITLE

### 0708045A - End Item Industrial Preparedness Activities

## PROJECT

### E25

COST (In Thousands)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total Cost
E25 MFG SCIENCE & TECH	59094	67324	66869	69495	70081	70635	72189	73777		549464

**A. Mission Description and Budget Item Justification:** The goal of this Army Manufacturing Technology (ManTech) project is to reduce costs and risks of manufacturing technologies that enable the affordable production and sustainment of future weapon systems for Future Combat Systems (FCS) and other Future Force systems, as well as the affordable transition of new technologies that can enhance capabilities of Current Force systems. Objectives address advanced manufacturing processes, equipment, and systems that enhance quality of products while achieving reductions in cost and/or that transfer improved manufacturing technologies to the industrial base. ManTech assists the Army in meeting FCS and Future Force performance, sustainability, and reliability goals and timelines and has potential to reduce risks and costs of new technologies for weapons systems. Efforts have potential for high payoff across the spectrum of Army weapon systems and significant positive impact on national manufacturing issues and the US industrial base. Current investment areas are: Aviation, Armor/Survivability, Sensors, Electronics/Power Systems, Precision Munitions/Armaments, and Flexible Displays. In Aviation, Low Cost Lightweight Structures (LCLWS) and Affordable Drive Train Housing (ADTH) efforts complete in FY07. In Armor/Survivability, the efforts in Structural Armor and Applique Armor address manufacturing/production of vehicle protective systems. The objective of Low Cost Manufacturing of Materials for Improved Warfighter Protection is to improve the current manufacturing processes headgear and body armor to enable a new generation of improved ballistic materials and multifunction fiber architectures to be introduced. In Sensors, the Dual Band Focal Plane Array Manufacturing (DBFM), and Uncooled Focal Plane Array (FPA) Producibility efforts completed in FY06. The third Generation (Gen) Infrared Dewar/Cooler Aperture (IDCA) effort, which complements the third Gen Infrared (IR) Technology effort conducted in PE 0603710A/K70/K86, is focused on improving manufacturing and assembly processes of the variable aperture mechanism (VAM), VAM components, and compact Dewar components, which are needed to optimize third Gen sensor performance for either wide area search scanning or long range identification. In Electronics/Power Systems, Software Defined Radio (SDR) Components matures manufacturing processes to provide the Joint Tactical Radio System (JTRS) with SDR standardized modules that can be used across all variants to reduce production costs; Phase Shifters for Phased Arrays (PSPA) provides manufacturing processes for on-the-move line of sight and beyond line of sight communications and missile seeker applications. Silicon Carbide (SiC) Switches matures fabrication processes for compact, power-dense SiC devices for Army systems; the High Energy Density (HED) Capacitor effort matures pulse power manufacturing processes for advanced protection systems and weapons; and Very High Power (VHP) Batteries matures manufacturing processes for compact energy/storage systems. In Precision Munitions/Armaments, the Durable Gun Barrel (DGB) effort, which competed in FY06, constructed and evaluated the performance of full-scale demonstration barrels utilizing advanced steel. The Low Cost High G Micro-Electro-Mechanical Systems (MEMS) Inertial Measurement Unit (IMU) effort, which complements an effort in PE/project 0602303A/214, focuses on achieving manufacturing processes that will produce an affordable inertial measurement system and deeply integrated guidance and navigation unit for missiles and armaments. MEMS Safe and Arm (S&A) matures MEMS wafer-based manufacturing processes and provides miniature, high-G "inertial mechanical logic" to control position of explosive charge for weapon systems applications. The Throttling Propulsion Component Manufacturing and Assembly for Missiles enables cost effective manufacturing of throttling components (pintle and throat) that provide enhanced energy management for Non Line of Sight-Launch Site (NLOS-LS) solid rocket propulsion; and Optimization of PAX-41 Formulation and Loading effort develops and matures the loading qualification process of PAX-41 explosives to meet new DoD regulations. The Flexible Display Initiative (FDI) effort in this project, which is fully coordinated with and complements the FDI effort in PE/project 0602705A/H94, provides manufacturing technologies required to enable the production of lightweight and rugged flexible displays that will reduce size and weight of computer displays for individual Soldiers and for vehicle applications.

## Accomplishments/Planned Program:

FY 2006

FY 2007

FY 2008

FY 2009

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Aviation Systems - LCLWS: In FY06, evaluated second tail cone, integrated tail cone onto test aircraft and conducted ground testing. In FY07, complete testing and evaluation of tail cone and complete flight qualification. ADTH: In FY06, finalized tooling design and initiated manufacturing of the outer gearbox housing. In FY07, complete gearbox-housing manufacturing, perform system integration, conduct testing and evaluation of gearbox housing, and complete flight qualification.	838	688			
Base Structural Armor: In FY06, demonstrated ability to meet stated manufacturing, cost, and weight goals of \$11.65 per pound and a 40 percent weight reduction; demonstrated a prototype production line, scaled up the low cost titanium plate process and demonstrated processes to grind both sides of ceramic tiles without loss of material strength. In FY07, automate and streamline subassembly processes and produce solid-state titanium plates; demonstrate ability to integrate dissimilar material structures and optimize assembly to maximize the strength of the combined materials and develop a ceramic tile encapsulation process. In FY08, will test and qualify integrated subassembly processes for FCS armor structure and hybrid mine floor. In FY09, will demonstrate manufacturing readiness level in the fabrication of full-up A and B upper and lower hull test asset in a production environment.	8345	14961	14712	20365	
Overlay Armor: In FY07, design and develop manufacturing technology for hybrid 3-D weave composites; benchmark and develop low cost manufacturing of high performance metal encapsulated armor; develop low cost manufacturing of ultra-high performance Aluminum metal matrix composite armor; develop manufacturing technique for U2 mine kit. In FY08, will continue addressing advanced armor solution affordability and initiate the development of manufacturing technologies for novel armor materials critical to B3 and U3 armor, deliver a multi-materials kit and supporting processes to include prepreg, particulate metal-matrix composites, nano-bonds, and backing that enable production of armor solutions. In FY09, will integrate stiffening materials and demonstrate producible, affordable armor manufacturing processes that include hybridized fibrous metal matrix composites and 3-D composites backing.		6404	19377	18361	
Low Cost Manufacturing of Materials for Improved Warfighter Protection: In FY06, identified candidate fabrication and processing technologies for fiber-based tows, thermoplastic matrices, and multifunctional materials to enable the next generation of Warfighter protection. In FY07, enable net shape pre-forms to reduce touch labor by 40 percent, reduce scrap waste of ballistic fibers and enable simultaneous processing of ballistic, structural, and multifunction materials for improved helmet performance. In FY08, will begin prototype fabrication and start next generation helmet shell process development, integrate light-weight head-borne communications systems and sensors. In FY09, will combine hydrostatic, multiple tow deposition, and multifunctional material technologies and start full-scale fabrication and production.	300	1773	1320	2280	
Sensors - DBFM: In FY06, increased yield molecular beam epitaxy process to 60 percent, small pixel to 60 percent, with an acceptance of 25 percent; and reduced cost to \$60,000 per dual band FPA. Uncooled FPA Producibility: In FY06, increased FPA yield to greater than 50 percent with a package yield of 98 percent for a unit cost less than \$2,000.	12066				
Third Gen IDCA: In FY06, addressed third Gen B-Kit cyro-cooler manufacturing cost and design modifications to enhance performance, and began fabrication of one unit for process verification and evaluation. In FY07, initiate manufacturing process improvement of Variable Aperture components to optimize sensor performance for either wide area search scanning or long range identification, begin precision assembly, motor pre-tension and production process of motor supply base for high reliability motors. In FY08, will develop Variable Aperture coating deposition processes, fabricate precision tooling, and test smaller motors to verify improved manufacturability of the Variable Aperture Mechanism while maintaining performance and improving reliability and survivability in the dewar vacuum environment. In FY09, will integrate variable aperture and compact cold stage components to validate tooling documentation and perform system demonstration.	505	2365	2935	6919	
SDR Components: In FY06, completed analysis of manufacturing process and defined methodology for qualification test. In FY07, prototype and mature manufacturing sub-process for common SDR core transceiver. In FY08 will demonstrate the manufacturability of	4900	8866	7500	5000	

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the Silicon Germanium RF Integrated Circuit through the fabrication and packaging of the final iteration, allowing for insertion into the JTRS Handheld, Manpack, Small Form Fit system providing a 60% size, 75 percent weight and 40 percent power reduction; test and integrate wideband power amplifier IC with the final version of the RF front end filters demonstrating a system improvement of 40 percent size, 40 percent weight, and 50 percent power consumption and the manufacturability of both will be enhanced with the insertion of automated testing and assembly. In FY09, will begin system integration of RF chipset, power amplifiers and wideband tunable filter for low rate production.					
PSPA: In FY06, improved automated processes to increase operational switch life, process yields, throughput, and reliability. In FY07, improve processes to reduce packaging and assembly costs, eliminate electrical malfunctions, and transition improved phase shifter design to Warfighter Information Network-Tactical (WIN-T). In FY08, will transition to the non line of sight and Aviation Common Modular Missile programs.		4040	3874	2315	
SiC Switches: In FY06, matured manufacturing processes for diodes and switches. In FY07, improve processes to reduce switch and diode costs from \$1.20/Ampere to 45 cents/Ampere for switches and from \$5/Ampere to 60 cents/Amp for diodes. In FY08, will reduce thickness of SiC material and improve doping uniformity. In FY09, will put 4" substrates and epi-layers into pilot production; reduce cost of low voltage diodes and switches.		4800	6076	6480	6170
HED Capacitor: In FY06, manufactured new packaging design for 5-fold increase in capacitor life. In FY07, increase operating voltage on film with scale-up units leading to demonstration for high energy FCS applications. In FY08, will increase operating voltage on film and increase shot life from <200 to 1000. In FY09, will improve design life of advanced films, put into production and demonstrate manufacturing technology.		3400	3645	2800	1600
VHP Batteries: In FY06, improved processes to increase battery safety with improved electrode and electrolyte materials. In FY07, design and implement improved cell processing, conduct cell trials, assemble, and test battery modules. In FY08, will improve battery pack manufacturing time from 950 hours to 350 hours and reduce cost from \$115 to \$58 a pack. In FY09, will increase cell performance from 1 kilowatt to 3 kilowatts while reducing cell capacity loss from 40 percent to 20 percent.		4700	4532	4200	3800
The Low Cost High G MEMS IMU: In FY06, completed design for the Phase III IMU configuration reducing from 4 cubic inches to 2 cubic inches; finalized design verification test plans and production acceptance test plans and completed the transition of the Accelerometer 4" line to the 6" line. In FY07, complete transition of the Gyro 4" line to the 6" line and initiate design verification tests and production acceptance tests for delivery of 36 IMU units and demonstrate integrated design and automation enhancements of final prototype IMUs.		2900	2954		
MEMS S&A: In FY06, implemented micro-fabrication processes, combined with explosive direct loading and test under XM29 and SX307 load conditions. In FY07, evaluate fabrication, loading, and automated assembly technologies safety and reliability, start qualification of the MEMS-based munitions and transition common MEMS S&A integrated with fuze electronics to Low Rate Initial Production.		3100	2759		
Precision Munitions/Armaments - DGB: In FY06, constructed and evaluated the performance of full-scale demonstration barrels utilizing advanced steel. Throttling Propulsion Component Manufacturing and Assembly for Missiles: In FY06, started Design-of-Experiments to reduce the advanced manufacturing process risk for solid rocket motor pintle and throat components that will enable affordable throttling propulsion components. In FY07, develop manufacturing processes to reduce production lead time by six weeks, and reduce component weight; validate thin coating process. In FY08, will begin missile qualification testing. Optimization of PAX 41: In FY06, developed initial manufacturing Design-of-Experiments for demonstrating affordable, repeatable PAX 41 insensitive munitions processes for large-		6000	1729	230	

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scale production. In FY07, establish a Six Sigma loading process for grenade bodies and optimize processing parameters for both energetic and munitions components. In FY08, will improve processes to reduce manufacturing production costs; establish a reliable loading process and transition technology.				
Flexible Displays: In FY06, matured technology to enable 4" displays on flexible substrates, and continued GEN II qualification of manufacturing processes for 15" diagonal backplane display drivers. In FY07, qualify the GEN II line for fabricating reflective and emissive displays; and integrate and fabricate flexible displays up to 7.5" diagonals from the 15" diagonal line. In FY08, will integrate reflective laminates and manufacture pilot line processes into GEN II production line. In FY09, will demonstrate pilot lines and manufacture GEN II reflective and emissive 7.5" displays.	3200	4926	5000	5000
Small Business Innovative Research/Small Business Technology Transfer Programs		1772		
Total	59094	67324	66869	69495
<b><u>B. Other Program Funding Summary</u></b> Not applicable for this item.				
<b><u>C. Acquisition Strategy</u></b> Not applicable for this item.				